

PATENT ABSTRACTS OF JAPAN

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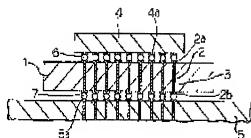
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(54) WIRING BOARD

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent a semiconductor device from malfunctioning by a noise which penetrates from an outer electric circuit board of the semiconductor element.

SOLUTION: The board comprises an insulation base 1 having through-holes 3 in the thickness direction and wiring layers 2 having first ends extending to the top face of the base 1, to form upper connection pads 2a connected to electrodes 4a of a semiconductor device 4 and second ends which extend to the bottom face of the base to form lower connection pads 2b connected to wiring conductors 5a of an outer electric circuit board 5. The base 1 is made of $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-MgO-MnO-B}_2\text{O}_3$ crystalline glass and contg. at least a magnetic material around the through-holes 3.



CLAIMS

[Claim(s)]

[Claim 1] A wiring board, wherein it is a wiring board characterized by comprising the following, and said insulating base comprises SiO_2 -aluminum $_2\text{O}_3$ - MgO - ZnO - B_2O_3 system crystallinity

glass and a magnetic material contains at least around a breakthrough.

An insulating base which has two or more breakthroughs in a thickness direction.

Two or more wiring layers which it fills up with in said breakthrough, form a top connection pad to which one end is drawn by the upper surface of an insulating base, and an electrode of a semiconductor device is connected, and form a lower connection pad to which the other end is drawn by the undersurface of an insulating base and a wiring conductor of an external electric circuit substrate is connected.

[Claim 2] The wiring board according to claim 1, wherein content of said magnetic material is 50 to 90 % of the weight.

[Claim 3] The wiring board according to claim 1 or 2 making said insulating base contain an inorganic substance filler of ten to 40 weight section by outside addition.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the wiring board by which loading connection of the semiconductor devices, such as LSI (large scale integration circuit element), is made.

[0002]

[Description of the Prior Art] Conventionally, the external electric circuit substrate by which loading connection of the semiconductor device is made comprises an insulating base which comprises electrical insulation materials, such as a nature sintered compact of an aluminum oxide, and two or more wiring conductors which are formed in the surface and the inside of this insulating base, and comprise metallic materials, such as tungsten, molybdenum, and manganese.

[0003] By generally adopting thick film formation art, such as the Mo-Mn method, this external electric circuit substrate is formed and specifically, To the metal powder which comprises refractory metals, such as tungsten, molybdenum, and manganese, an organic binder, Add a solvent etc. and print coating of paste state and the made metal paste is carried out to the prescribed pattern which serves as a wiring conductor with screen printing in the outside surface of raw or a sintered ceramic object, Next, this is calcinated in reducing atmosphere and it is formed by carrying out the sintering unification of a refractory metal and the ceramic body.

[0004] Corresponding to the miniaturization of electronic equipment, an external electric circuit substrate is also recently made small, And since it is required that a wiring conductor should be formed with high density and it corresponds to this, the external electric circuit substrate which changed the wiring conductor into forming with thick film formation art, and was formed by the thin film coating technology in which fine wiring is possible has also come to be used.

[0005] The external electric circuit substrate which formed this wiring conductor by thin film coating technology, The glue line which comprises tantalum nitride, a nickel chrome alloy, etc. on an insulating base, for example, The interlayer who comprises a nickel chrome alloy, a titanium tungsten alloy, nickel, palladium, etc., The initiative body whorl which comprises gold, copper, etc. is made to laminate one by one by adopting thin film coating technology, such as the ion plating method, sputtering process and vacuum deposition, and plating, next these each class is processed into a prescribed pattern with photolithography technology, and it is formed by considering it as a wiring conductor.

[0006] The semiconductor device to which this external electric circuit substrate has an electrode on the undersurface at the upper surface of an insulating base is laid, By joining the wiring conductor on the upper surface of an insulating base, and the electrode of the undersurface of a semiconductor device via Hitoshi Handa, loading connection of the semiconductor device will be made and a semiconductor device drives by taking a predetermined electrical signal in and out of a semiconductor device via a wiring conductor.

[0007]

[Problem(s) to be Solved by the Invention] However, the thing which an information processor is what highly efficient-ization progresses rapidly, and a high speed drive is performed in connection with this as for a semiconductor device, and is very easy to be influenced by a noise in recent years, Since the wiring conductor with which the conventional external electric

circuit substrate comprises tungsten, molybdenum, etc. made the noise of harmonics spread easily, when the noise of harmonics enters into the wiring conductor of a wiring board, This noise entered into the semiconductor device via the wiring conductor as it is, and had a fault of making a semiconductor device malfunction.

[0008] This invention was thought out in view of the above-mentioned fault, and the purpose, It is allotted between a semiconductor device and the conventional external electric circuit substrate, the noise which entered into the wiring conductor of an external electric circuit substrate is effectively prevented from entering into a semiconductor device as it is, and it is in providing the wiring board which can operate a semiconductor device normally over a long period of time.

[0009]

[Means for Solving the Problem] It fills up with this invention an insulating base which has two or more breakthroughs in a thickness direction, and in said breakthrough, A top connection pad to which an end is drawn by the upper surface of an insulating base and an electrode of a semiconductor device is connected is formed, It is a wiring board which comprises two or more wiring layers which form a lower connection pad to which the other end is drawn by the undersurface of an insulating base and a wiring conductor of an external electric circuit substrate is connected, Said insulating base comprises SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass, and a magnetic material contains it at least around the breakthrough.

[0010] This invention is characterized by content of said magnetic material being 50 to 90 % of the weight.

[0011] This invention made said insulating base contain an inorganic substance filler of ten to 40 weight section by outside addition.

[0012] According to the wiring board of this invention. When a noise spreads to a wiring layer provided in an insulating base since [to which a wiring layer is allotted while forming an insulating base with SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass] a magnetic material was made to contain at least around a breakthrough, With a magnetic material, the noise is changed into thermal energy, and is absorbed, as a result, a noise does not enter into a semiconductor device, and it becomes possible to always operate a semiconductor device normally.

[0013] According to the wiring board of this invention, calcination temperature of SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass which forms an insulating base is 800-1050 **, Since it is low, even if a magnetic material is made to contain and it calcinates it in this crystalline glass, a magnetic material does not lose magnetism, and it becomes possible to absorb a noise good.

[0014] The melting point of copper, silver, gold, etc. low [since calcination temperature of a glass ceramic sintered body is simultaneously low] **, When it becomes possible to form a wiring layer which comprises a low material of conduction resistance by simultaneous calcination and an electrical signal spreads a wiring layer, attenuation etc. can be effectively prevented from arising in an electrical signal, and a semiconductor device can also be operated correctly.

[0015] If an insulating base is made to contain an inorganic substance filler in the range of ten to 40 weight section by outside addition, a mechanical strength of an insulating base will

become strong, and breakage etc. can also be effectively prevented from inviting by external force impression.

[0016]

[Embodiment of the Invention]Next, this invention is explained in detail based on an accompanying drawing. Drawing 1 shows one example of the wiring board of this invention, 1 is an insulating base and 2 is a wiring layer.

[0017]Said insulating base 1 comprises SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO- B_2O_3 system

crystallinity glass, Two or more breakthroughs 3 penetrated to the thickness direction are formed, and the wiring layer 2 which comprises the small metallic material of the conduction resistance which comprises copper, silver, gold, etc. is formed in this breakthrough 3.

[0018]The insulating base 1 which comprises said SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO- B_2O_3

system crystallinity glass, For example, SiO_2 , aluminum $_2\text{O}_3$, MgO, ZnO, the suitable organic binder for the glass component powder which comprises B_2O_3 , The green sheet (raw sheet) of

two or more sheets is obtained by adopting a well-known doctor blade method, the calendering roll method, etc. conventionally, and fabricating this to a sheet shaped, while carrying out addition mixing of a solvent, the plasticizer, etc. and making with the shape of slurry, Next, while performing suitable punching processing for said green sheet, it laminates up and down in predetermined order, and while making with a generation form, it is manufactured by calcinating this generation form at the temperature of 800-1050 **.

[0019]The breakthrough 3 currently formed in said insulating base 1 is formed in 80 micrometers - 250 micrometers in diameter, for example by adopting the punching drilling processing method by a well-known metallic mold as the green sheet (raw sheet) which serves as the insulating base 1 by calcination conventionally.

[0020]The wiring layer 2 is formed in the breakthrough 3 formed in said insulating base 1, While this wiring layer 2 makes the operation which electrically connects the wiring conductor 5a of the external electric circuit substrate 5, and the electrode 4a of the semiconductor device 4, makes the upper surface of the insulating base 1 draw the end of the wiring layer 2 and forms the top connection pad 2a, The other end is drawn by the undersurface of the insulating base 1, and lower connection pad 2b is formed, The electrode 4a of the semiconductor device 4 is joined to the top connection pad 2a via the conductive jointing material 6 which comprises Hitoshi Handa, If lower connection pad 2b is made to join the wiring conductor 5a of the external electric circuit substrate 5 via the conductive jointing material 7 which comprises Hitoshi Handa, the electrode 4a of the semiconductor device 4 will be connected to the wiring conductor 5a of the external electric circuit substrate 5 via the wiring layer 2, By this, from an external electric circuit, an electrical signal can take in and out of the semiconductor device 4, and the semiconductor device 4 can be operated.

[0021]Said wiring layer 2 has the low melting point of copper, silver, gold, etc., and it is formed with the small metallic material of conduction resistance, Carry out addition mixing of an organic binder, a solvent, the plasticizer, etc. at metal powder, such as copper, silver, and gold, and metal paste is created, It is filled up with this metal paste by calcination in the breakthrough provided in the green sheet (raw sheet) used as the insulating base 1, and is formed by calcination of a green sheet and simultaneous calcination in the breakthrough 3 of the insulating base 1. In this case, since that calcination temperature of SiO_2 -aluminum $_2\text{O}_3$ -

MgO-ZnO-B₂O₃ system crystallinity glass is as low as 800-1050 **, The metal powder of metal paste does not exhalate at the time of calcination of the insulating base 1, and it can form in the breakthrough 3 of the insulating base 1 by the insulating base 1 and simultaneous calcination.

[0022] Said wiring layer 2 can prevent attenuation etc. from arising in an electrical signal effectively, even if an electrical signal spreads the wiring layer 2, since conduction resistance, such as copper, silver, and gold, is formed with the low metallic material, and as a result, it can operate the semiconductor device 4 correctly.

[0023] The insulating base 1 which has the wiring layer 2 in said breakthrough 3, To the inside, ZnFe₂O₄, MnFe₂O₄, FeFe₂O₄. The magnetic material which comprises at least one sort of CoFe₂O₄, NiFe₂O₄, and CuFe₂O₄ contains, When the harmonic noise which entered into the wiring layer 2 from the external electric circuit spreads this magnetic material, the noise is changed into thermal energy, and is absorbed, the operation which prevents a noise from entering into a semiconductor device effectively is made, and it becomes possible by this to make it always operate normally of a semiconductor device.

[0024] Said magnetic material to the green sheet which serves as the insulating base 1 by calcination, for example. It contains in the insulating base 1 by carrying out addition content of the magnetic powder which comprises at least one sort of ZnFe₂O₄, MnFe₂O₄, FeFe₂O₄, CoFe₂O₄, NiFe₂O₄, and CuFe₂O₄.

[0025] The insulating base 1 containing said magnetic material, i.e., SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass, The quantity of SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass the insulating base 1 which comprises a magnetic material Less than 10 % of the weight, It becomes difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass will become high, and changes from metallic materials, such as copper, when it becomes that in which in other words the magnetic material exceeded 90 % of the weight, If the quantity of SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass exceeds 50 % of the weight, and in other words a magnetic material will be less than 50 % of the weight, When a noise enters into the wiring layer 2 provided in the insulating base 1 from the wiring conductor 5a of the external electric circuit substrate 5, a noise will not be able to be absorbed good but the semiconductor device 4 will be made to cause malfunction. Therefore, the insulating base 1 which made said SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass contain a magnetic material, It is preferred to make quantity of SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass into 10 to 50% of the weight of the range, and to make quantity of a magnetic material into 50 to 90% of the weight of the range.

[0026] If said magnetic material is set [the particle diameter] to less than 0.5 micrometer again, when manufacturing the insulating base 1 by calcination, A reaction with SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass advances, The survival rate of a magnetic material falls and it becomes impossible to absorb a noise effectively, If it exceeds 10 micrometers, it will become difficult to calcinate simultaneously with the wiring layer 2 to

which the calcination temperature of SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for said magnetic material, what the particle diameter is made into the range of 0.5 micrometer - 10 micrometers for is preferred.

[0027]It is important to form the insulating base 1 with SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass in the wiring board of this invention.

[0028]This SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass, For example, SiO_2 :40-46 % of the weight, aluminum $_2\text{O}_3$:25-30 % of the weight, MgO:8-13 % of the weight, ZnO: It is formed at 6 to 9 % of the weight, and B $_2\text{O}_3$:8-11 % of the weight.

[0029]Said SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass, Although crystal phases, such as gahnite (ZnO-aluminum $_2\text{O}_3$), cordierite (2MgOand2aluminum $_2\text{O}_3$), and a spinel type crystal phase (MgO-aluminum $_2\text{O}_3$, ZnO-aluminum $_2\text{O}_3$), are generated at the time of calcination, It has the character in which the intensity of the insulating base 1 improves by generation of these crystal phases.

[0030]From 800-1050 ** and a low thing, the calcination temperature said SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass. When the melting point of copper, silver, gold, etc. is enabled to form the wiring layer 2 by the insulating base 1 and simultaneous calcination also as a low low material of ** and conduction resistance and an electrical signal spreads the wiring layer 2, attenuation etc. can be effectively prevented from arising in an electrical signal, and the semiconductor device 4 can be operated correctly.

[0031]Since the calcination temperature of said SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass is as low as 800-1050 **, even if it makes the magnetic material contain at the time of calcination, the magnetism of a magnetic material is not lost, It becomes possible to absorb the noise which entered into the wiring layer 2 by this good.

[0032]The specific inductive capacity low said SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass with about 5 (room temperature of 1 MHz) again **. Therefore, even if it makes the wiring layer 2 allotted in the breakthrough 3 of the insulating base 1 spread an electrical signal, a propagation delay is not invited, and it becomes possible to make the wiring layer 2 spread an electrical signal by this at high speed.

[0033]Said SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass, If the quantity of SiO_2 exceeds less than 40 % of the weight or 46 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of SiO_2 , what is considered as 40 to 46% of the weight of the range is preferred.

[0034]If the quantity of aluminum $_2\text{O}_3$ exceeds less than 25 % of the weight or 30 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO_2 -aluminum $_2\text{O}_3$ -MgO-ZnO-B $_2\text{O}_3$ system crystallinity glass will

become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of aluminum₂O₃, what is considered as 25 to 30% of the weight of the range is preferred.

[0035]When the insulating base 1 which comprises SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass by calcination when the quantity of MgO will be less than 8 % of the weight is manufactured, Quantity of the cordierite (2MgO and 2aluminum₂O₃) to generate can decrease, and intensity of the insulating base 1 cannot be raised greatly. If it exceeds 13 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO₂-Al₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of MgO, what is considered as 8 to 13% of the weight of the range is preferred.

[0036]When the insulating base 1 which comprises SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass by calcination when the quantity of ZnO will be less than 6 % of the weight is manufactured, Quantity of the gahnite (ZnO-aluminum₂O₃) to generate can decrease, and intensity of the insulating base 1 cannot be raised greatly. If it exceeds 9 % of the weight, it will become difficult to calcinate simultaneously with the wiring layer 2 to which the calcination temperature of SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass will become high, and changes from metallic materials, such as copper. Therefore, as for the quantity of ZnO, what is considered as 6 to 9% of the weight of the range is preferred.

[0037]When the insulating base 1 which comprises SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass by calcination when the quantity of B₂O₃ will be less than 8 % of the weight is manufactured, Gahnite (ZnO-aluminum₂O₃), cordierite (2MgO and 2aluminum₂O₃), Crystal phases, such as a spinel type crystal phase (MgO-aluminum₂O₃, ZnO-aluminum₂O₃), are generated superfluously. If the insulating base 1 becomes a porous thing, and it becomes unsuitable as a wiring board and it exceeds 11 % of the weight, chemical resistance will deteriorate greatly and the reliability as a wiring board will fall greatly. Therefore, as for the quantity of B₂O₃, what is considered as 8 to 11% of the weight of the range is preferred.

[0038]On an inorganic substance filler and a concrete target, said SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass at the inside Alumina, If 10-40 weight-section addition content of the powder, such as silica, silicon nitride, and aluminum nitride, is carried out by outside addition, it will be effectively prevented from a mechanical strength improving substantially and inviting breakage etc. by external force impression. Therefore, the mechanical strength of the insulating base 1 is raised. As for making it not invite breakage etc. by external force impression, it is preferred to make said SiO₂-aluminum₂O₃-MgO-ZnO-B₂O₃ system crystallinity glass carry out 10-40 weight-section addition content of the inorganic substance filler by outside addition, and to form the insulating base 1 in it.

[0039]If the particle diameter is further made into the range of 0.5-5 micrometers, said inorganic substance filler can carry out distributed content uniformly into a glass ceramic sintered body, and can raise the mechanical strength of the insulating base 1 uniformly. Therefore, as for said inorganic substance filler, what the particle diameter is made into the

range of 0.5–5 micrometers for is preferred.

[0040] This invention is not limited to an above-mentioned example, when it was a range which does not deviate from the gist of this invention, it made the whole insulating base 1 various change contain a magnetic material in an above-mentioned example possible, but it may make a magnetic material contain only on the outskirts of breakthrough 3 of the insulating base 1. In this case, what is necessary is to make into the range of 10–50 quantity of the SiO_2 –

aluminum₂O₃–MgO–ZnO–B₂O₃ system crystallinity glass of the field which a magnetic material contains, and just to let quantity of the magnetic material be 50 to 90% of the weight of a range.

[0041] Although the Plastic solid which laminated two or more green sheets was calcinated and the insulating base 1 was created in the above-mentioned example, one Plastic solid which fabricated this by press forming etc. may be calcinated and created. The thing which made SiO_2 –aluminum₂O₃–MgO–ZnO–B₂O₃ system crystallinity glass contain a magnetic material when calcinating the Plastic solid which laminated two or more green sheets simultaneously and creating the insulating base 1, The thing which made SiO_2 –aluminum₂O₃–MgO–ZnO–B₂O₃ system crystallinity glass contain an inorganic substance filler may be allotted to a multilayer, and may be created.

[0042]

[Effect of the Invention] According to the wiring board of this invention. When a noise spreads to the wiring layer provided in the insulating base since [to which a wiring layer is allotted while forming an insulating base with SiO_2 –aluminum₂O₃–MgO–ZnO–B₂O₃ system crystallinity glass] the magnetic material was made to contain at least around a breakthrough, With a magnetic material, the noise is changed into thermal energy, and is absorbed, as a result, a noise does not enter into a semiconductor device, and it becomes possible to always operate a semiconductor device normally.

[0043] According to the wiring board of this invention, the calcination temperature of the SiO_2 –aluminum₂O₃–MgO–ZnO–B₂O₃ system crystallinity glass which forms an insulating base is 800–1050 **, Since it is low, even if a magnetic material is made to contain and it calcinates it in this crystalline glass, a magnetic material does not lose magnetism, and it becomes possible to absorb a noise good.

[0044] The melting point of copper, silver, gold, etc. low [since the calcination temperature of a glass ceramic sintered body is simultaneously low] **, When it becomes possible to form the wiring layer which comprises a low material of conduction resistance by simultaneous calcination and an electrical signal spreads a wiring layer, attenuation etc. can be effectively prevented from arising in an electrical signal, and a semiconductor device can also be operated correctly.

[0045] If an insulating base is made to contain an inorganic substance filler in the range of ten to 40 weight section by outside addition, the mechanical strength of an insulating base will become strong, and breakage etc. can also be effectively prevented from inviting by external force impression.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a sectional view showing one example of the wiring board of this invention.

[Description of Notations]

1 ... Insulating base

2 ... Wiring layer

2a .. Top connection pad

2b .. Lower connection pad

3 ... Breakthrough

4 ... Semiconductor device

4a .. Electrode of a semiconductor device

5 ... External electric circuit substrate

5a .. Wiring conductor of an external electric circuit substrate

[Translation done.]

